

WHAT IS CLAIMED IS:

- 1 1. A system for bias control of a power amplifier, comprising:
 - 2 a carrier amplifier coupled to an input stage for amplifying an input signal; and
 - 3 a peak amplifier coupled to the input stage for amplifying the input signal, the peak
 - 4 amplifier configured to receive a voltage control signal for biasing the peak
 - 5 amplifier, the voltage control signal based on power levels of signals transmitted by
 - 6 a remote base station.
- 1 2. The system of claim 1, wherein the carrier amplifier further comprises
 - 2 a carrier first stage amplifier coupled to the input stage; and
 - 3 a carrier second stage amplifier coupled to the carrier first stage amplifier and a carrier
 - 4 amplifier output terminal.
- 1 3. The system of claim 1, wherein the peak amplifier further comprises
 - 2 a peak first stage amplifier coupled to the input stage; and
 - 3 a peak second stage amplifier coupled to the peak first stage amplifier and a peak amplifier
 - 4 output terminal; and
 - 5 a voltage control unit coupled to the peak second stage amplifier, the voltage control unit
 - 6 configured to bias the peak amplifier via the received voltage control signal.
- 1 4. The system of claim 3, wherein the voltage control unit biases the peak amplifier as a class
 - 2 B or a class C amplifier based upon a state of the received voltage control signal.

1 5. The system of claim 3, wherein the voltage control unit biases the peak amplifier as a class
2 AB amplifier based upon a state of the received voltage control signal.

1 6. The system of claim 1, wherein the power amplifier is configured to generate the voltage
2 control signal in a first state if the power levels of the signals transmitted by the remote base station
3 indicate that the power amplifier operates in a low output power range.

1 7. The system of claim 1, wherein the power amplifier is configured to generate the voltage
2 control signal in a second state if the power levels of the signals transmitted by the remote base
3 station indicate that the power amplifier operates in a high output power range.

1 8. The system of claim 1, further comprising a 3dB hybrid coupler configured to receive the
2 input signal from the input stage, send a first input signal to an input of the carrier amplifier, and
3 send a second input signal to an input of the peak amplifier, the second input signal shifted in
4 phase by approximately ninety degrees from the first input signal.

1 9. The system of claim 8, further comprising an output matching unit configured to receive an
2 output signal from the peak amplifier and an output signal from the carrier amplifier to generate a
3 substantially optimum power amplifier output power signal at an output stage.

1 10. The system of claim 9, wherein the output matching unit further comprises
2 a first quarter wavelength transformer coupled to a carrier amplifier output terminal; and
3 a second quarter wavelength transformer coupled to a peak amplifier output terminal, an
4 output of the first quarter wavelength transformer, and the output stage.

- 1 11. A method for bias control of a power amplifier, comprising:
 - 2 receiving signals transmitted by a remote base station;
 - 3 generating a voltage control signal based upon power levels of the signals; and
 - 4 biasing a peak amplifier of the power amplifier via the voltage control signal.

- 1 12. The method of claim 11, wherein the generating further comprises the step of generating the
 - 2 voltage control signal in a first state if the power levels of the signals indicate that the power
 - 3 amplifier operates in a low output power range.

- 1 13. The method of claim 12, wherein the voltage control signal in the first state biases the peak
 - 2 amplifier as a class B or a class C amplifier.

- 1 14. The method of claim 11, wherein the generating further comprises the step of generating the
 - 2 voltage control signal in a second state if the power levels of the signals indicate that the power
 - 3 amplifier operates in a high output power range.

- 1 15. The method of claim 14, wherein the voltage control signal in the second state biases the
 - 2 peak amplifier as a class AB amplifier.

1 16. A system for controlling a power amplifier in a mobile handset, comprising:
2 a carrier amplifier having a carrier input terminal and a carrier output terminal;
3 a peak amplifier having a peak input terminal, a peak output terminal and a control
4 terminal for receiving a voltage control signal, the peak amplifier configured to
5 vary at least one characteristic of the power amplifier based upon the voltage
6 control signal;
7 a phase shifter, coupled to the carrier input terminal and the peak input terminal, for
8 generating a peak amplifier input signal delayed in phase from a carrier amplifier
9 input signal; and
10 an output matching unit, coupled to the carrier output terminal and the peak output
11 terminal, for transmitting a carrier output power signal and a peak output power
12 signal and forming a power amplifier output power signal at a power amplifier
13 output stage.

1 17. The system of claim 16, further comprising a baseband modem chipset for receiving signals
2 transmitted by a remote base station and generating the voltage control signal in a first voltage
3 state if power levels of the received signals indicate that the power amplifier operates within a low
4 power range and generating the voltage control signal in a second voltage state if the power levels
5 of the received signals indicate that the power amplifier operates within a high power range.

1 18. The system of claim 16, wherein the phase shifter is a hybrid coupler for distributing certain
2 input powers to the carrier amplifier and the peak amplifier.

- 1 19. The system of claim 18, wherein the hybrid coupler is a 3dB hybrid coupler implemented
2 with lumped elements.
- 1 20. The system of claim 18, wherein the hybrid coupler is implemented by the Low
2 Temperature Co-fired Ceramic (LTCC) method.
- 1 21. The system of claim 16, wherein the phase shifter is a phase difference compensator.
- 1 22. The system of claim 21, wherein the phase difference compensator is implemented with a
2 transmission line.
- 1 23. The system of claim 21, wherein the phase difference compensator is implemented with
2 lumped elements.
- 1 24. The system of claim 16, wherein the output matching unit is implemented with lumped
2 elements.
- 1 25. The system of claim 16, wherein the output matching unit is implemented by a Low
2 Temperature Co-fired Ceramic (LTCC) method.
- 1 26. The system of claim 16, wherein the at least one characteristic of the power amplifier is
2 linearity.

1 27. The system of claim 17, wherein the peak amplifier further comprises a voltage control unit
2 configured to receive the voltage control signal and control a bias current of the peak amplifier
3 such that the power amplifier is operated as a Doherty-type amplifier when the voltage control
4 signal is in the first voltage state and the peak amplifier is operated as a class AB amplifier when
5 the voltage control signal is in the second voltage state.

1 28. The system of claim 16, wherein the output matching unit further comprises
2 a first transformer having an input coupled to the carrier output terminal and an output
3 coupled to the peak output terminal; and
4 a second transformer having an input coupled to the output of the first transformer and an
5 output coupled to the power amplifier output stage.

1 29. A method of operating a power amplifier in a wireless transmitting device in at least two
2 modes, the power amplifier including a carrier amplifier and a peak amplifier, the method
3 comprising:
4 generating a voltage control signal in a first voltage state if power levels of signals
5 transmitted by a remote base station and received by the power amplifier indicate that
6 the power amplifier operates within a low power range;
7 generating a voltage control signal in a second voltage state if the power levels of signals
8 transmitted by the remote base station and received by the power amplifier indicate
9 that the power amplifier operates within a high power range; and
10 biasing the peak amplifier via the voltage control signal.

- 1 30. The method of claim 29, wherein biasing further comprises the step of biasing the peak
2 amplifier via the voltage control signal in the first voltage state to operate the power amplifier as a
3 Doherty-type amplifier.
- 1 31. The method of claim 29, wherein biasing further comprises the step of biasing the peak
2 amplifier via the voltage control signal in the second voltage state to improve a non-linearity
3 characteristic of the power amplifier.
- 1 32. The method of claim 29, wherein biasing further comprises the step of biasing the peak
2 amplifier via the voltage control signal in the second voltage state to operate the peak amplifier as
3 a class AB amplifier.
- 1 33. A system of operating a power amplifier in a wireless transmitting device in at least two
2 modes, the power amplifier including a carrier amplifier and a peak amplifier, the method
3 comprising:
4 means for generating a voltage control signal in a first voltage state if power levels of
5 signals transmitted by a remote base station and received by the power amplifier
6 indicate that the power amplifier operates within a low power range;
7 means for generating a voltage control signal in a second voltage state if the power levels of
8 signals transmitted by the remote base station and received by the power amplifier
9 indicate that the power amplifier operates within a high power range; and
10 means for biasing the peak amplifier via the voltage control signal.

1 34. The system of claim 33, wherein means for biasing further comprises means for biasing the
2 peak amplifier to operate the power amplifier as a Doherty-type amplifier if the voltage control
3 signal is in the first voltage state.

1 35. The method of claim 33, wherein means for biasing further comprises means for biasing the
2 peak amplifier to improve a non-linearity characteristic of the power amplifier if the voltage
3 control signal is in the second voltage state.